

## PATENT SPECIFICATION



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578,845

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## PROVISIONAL SPECIFICATION

## Improvements in or relating to Projectiles for use against Armour Plate and the like

We, JAMES TAYLOR, a British subject, of 7, Winton Circus, Saltcoats, Ayrshire, Scotland, and (GEORGE FREDERICK WHITBY, a British subject, and IMPERIAL CHEMICAL INDUSTRIES LIMITED, a British Company, both of Imperial Chemical House, Millbank, London, S.W.1, do hereby declare the nature of this invention to be as follows:—

10 This invention relates to bombs, grenades, or other explosive projectiles suitable for use against armour plate and of the kind containing a charge of explosive loaded under pressure into a two-part casing of which the foremost part is constructed of relatively thin material and is adapted easily to collapse on impact of the projectile against the target surface. The invention relates especially to a particular class of projectiles of the kind described, the said particular class being referred to hereinafter as hollow-charge projectiles, comprising a two-part casing, a charge of explosive compressed therein, which charge is recessed to provide a cavity preferably conical at the forward end of the body of the projectile, a metal lining of substantial thickness in immediate contact with the recessed surface of the charge, a priming charge located near the base of the explosive charge and means secured to the nose of the projectile and arranged to bring about detonation of the charge. The said means arranged to bring about detonation of the charge may for example consist of a detonator located at the nose of the projectile adapted to be initiated when the projectile strikes an impact surface, and a length of detonating fuse arranged to transmit the detonation to the priming charge.

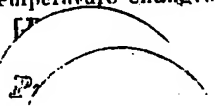
In projectiles of the kind described the charge of explosive is compressed either between the two parts of the casing or, in the case of the hollow-charge projectiles, between the rear part of the casing and the metal lining, and difficulty may be experienced in allowing for the thermal expansion of the highly compressed charge if the projectiles are subjected to temperature changes of any considerable

magnitude. Moreover, in the loading of projectiles of the kind described, it is necessary to apply considerable pressure to the charge while the two parts of the casing are being assembled, and to maintain this pressure after assembly. It is difficult to carry out such operations if the two parts of the casing are designed to be secured together by a screwed or bayonet joint, owing to the danger caused by rotation of the one part relative to the other in the presence of the explosive charge. This is especially true in the case of the hollow-charge projectiles where there is risk of the explosive creeping past the end of the metal lining and into the screwed joint.

The object of the present invention is to provide an improved projectile of the kind described in which the foregoing difficulties are overcome, and which provides a simple, effective and safe method of assembling the projectile.

According to the present invention a projectile of the kind described includes a two-part casing comprising a front part and a rear part adapted to be assembled under pressure but without relative rotational movement between the said parts, means adapted to hold the two parts of the casing together after such assembly, and a resilient washer located between two flanges secured to or rigidly associated with the front part and rear part respectively, said resilient washer permitting longitudinal displacement of the front part relative to the rear part under the influence of temperature changes. In the case of hollow-charge projectiles of the kind described the metal lining is rigidly associated with the front part of the casing so that the resilient washer permits longitudinal displacement of the said metal lining relative to the back part of the casing under the influence of temperature changes.

The retaining means adapted to hold the two parts of the casing together conveniently consists of a ring screwed on to the rear part and provided with an inwardly directed flange in sliding contact with the front part. This flange acts as



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the forward bearing surface for the resilient washer while the rear surface of the washer bears against an outwardly directed flange on the front-part of the casing. The metal liner also bears against this latter flange so that after assembly the metal liner and the front part of the casing are in rigid association but capable of moving together in relation to the rear part of the casing to a limited extent governed by the resilience of the washer.

The invention also includes a method of assembling two-part hollow charge projectiles of the kind described according to which the charge of explosive is loaded into the rear part of the casing, the liner and the front part of the casing then being inserted in position and the charge compressed, without rotary movement between the two parts, by axial pressure applied to the liner through the front part, and the two parts thereafter being secured together by retaining means co-operating with the flexible washer.

One embodiment of our invention as applied to a hollow-charge projectile is illustrated by way of example in the accompanying drawings in which

Figure 1 is a part sectional elevation of a hollow-charge projectile constructed in accordance with the invention.

Figure 2 is a sectional elevation on an enlarged scale of a portion of the projectile shown in Figure 1.

Referring to the drawings a hollow-charge projectile casing comprises a front part 1 and rear part 2 and contains an explosive charge 3 compressed between the rear part 2 and a conical metal lining 4. The front part of the casing is provided with a nose-fuze 5 adapted to be detonated on impact with the target, the detonation being transmitted by means of a detonating fuze 6 to a priming charge 7 located near the base of the explosive charge 3. The front part of the casing is provided with an outwardly directed flange 8 adapted to enter the mouth of the rear part and to be held in abutment with the rim of the conical lining 4 by a re-entrant flange 9 which constitutes the rear end of the front part of the casing. A resilient felt washer 10 is adapted to fit over the said front part to bear against the flange 8 thereon with in the mouth of the rear part of the

casing, the axial thickness of the said washer being such that a portion thereof protrudes from the mouth of the rear part of the casing. The mouth of the said rear part is provided with a rolled-on screw thread adapted to engage a corresponding thread 11 within a ring 12, which ring is also provided with an inwardly directed flange 13 adapted to bear against the protruding portion of the resilient washer.

An annular V-section sealing ring 14 is provided in the interior of the rear portion to prevent the explosive charge being forced into the annular space occupied by the washer. A strip of adhesive tape 15 is also secured around the re-entrant flange 9 of the front part of the casing in such manner as to prevent metallic frictional engagement between the front and rear parts of the casing during assembly after loading. The rear part of the casing of the projectile is provided with an extension 16 on which is mounted a tail unit 17 adapted to guide the projectile in its flight towards the target.

Assembly of the projectile is effected by the following sequence of operations. The rear part of the casing with associated parts pre-assembled thereon is loaded with the priming and explosive charges, the sealing-ring 14 being held in position on the inner wall during the loading in the form of a plain annular ring of which the upper portion is subsequently turned inwardly over the explosive charge. The front part of the casing with the conical lining and adhesive tape 15 secured there-to is then entered within the mouth of the rear part without relative rotational movement between the parts. The resilient washer is then entered into its housing and the threaded ring 12 positioned for screwing on to the rear part. Axial pressure without relative rotational movement is then exerted on the said front and rear parts and assembly is completed by screwing the ring on to the threaded portion of the rear part to compress the resilient washer between the flange 8 on the front part and the flange 13 on the ring.

Dated the 11th day of November, 1942.

E. A. BINGEN.

Solicitor for the Applicants.

#### COMPLETE SPECIFICATION

#### Improvements in or relating to Projectiles for use against Armour Plate and the like

We, JAMES TAYLOR, a British subject, of 7, Winton Circus, Saltcoats, Ayrshire,

Scotland, and GEORGE FREDERICK WHITBY, a British subject, and IMPERIAL

CHEMICAL INDUSTRIES LIMITED, a British Company, both of Imperial Chemical House, Millbank, London, S.W.1, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to explosive projectiles suitable for use against armour plate and of the kind comprising a two-part casing of which the foremost part is constructed of relatively thin material and is adapted easily to collapse on impact of the projectile against the target surface, a charge of explosive compressed within said casing and recessed to provide a cavity preferably conical at the forward end of the body of the projectile, a metal lining in immediate contact with the recessed surface of the charge, a priming charge located near the base of the explosive charge, and means secured to the nose of the projectile and arranged to bring about detonation of the charge on impact of the projectile against the target surface. The said means arranged to bring about detonation of the charge may for example consist of a detonator located at the nose of the projectile adapted to be initiated when the projectile strikes an impact surface, and a length of detonating fuze arranged to transmit the detonation to the priming charge.

In projectiles of the kind described the charge of explosive is compressed between the rear part of the casing and the metal lining, and difficulty may be experienced in allowing for the thermal expansion of the highly compressed charge if the projectiles are subjected to temperature changes of any considerable magnitude. Moreover, in the loading of projectiles of the kind described, it is necessary to apply considerable pressure to the charge while the two parts of the casing are being assembled, and to maintain this pressure after assembly. It is difficult to design the two parts of the casing to be secured together by a screwed or bayonet joint without involving a risk of explosive creeping into the joint and constituting a source of danger on rotation of the one part relative to the other.

The object of the present invention is to provide an improved projectile of the kind described in which the foregoing difficulties are overcome, and which provides a simple, effective and safe method of assembling the projectile.

According to the present invention a projectile of the kind described includes a two-part casing comprising a front part and a rear part adapted to be assembled

under pressure but without relative rotational movement between the said parts, an abutment on the front of the casing against which the metal lining bears, retaining means in screw threaded engagement with the rear part of the casing and adapted to hold the two parts together after such assembly, and a resilient washer located between two flanges formed on the front part of the casing and on the retaining means respectively, said resilient washer permitting longitudinal displacement of the front part and the metal lining relative to the rear part under the influence of temperature changes.

The retaining means adapted to hold the two parts of the casing together conveniently consists of a ring screwed on to the rear part and provided with an inwardly directed flange in sliding contact with the front part. This flange acts as the forward bearing surface for the resilient washer while the rear surface of the washer bears against an outwardly directed flange on the front part of the casing. The metal liner is also caused, by reason of the pressure exerted upon it in a forward direction by the compressed charge of explosive, to bear against the inner surface of this latter flange. After assembly the metal liner and the front part of the casing are capable of moving together in relation to the rear part of the casing to a limited extent governed by the resilience of the washer.

The invention also includes a method of assembling two-part projectiles of the kind described according to which the charge of explosive is loaded into the rear part of the casing, the liner and the front part of the casing then being inserted in position and the charge compressed, without relative rotational movement between the parts, by axial pressure applied to the liner through the front part, the said front and rear parts being thereafter secured together by screwing on to the rear part of the casing retaining means co-operating with a resilient washer located between two flanges formed on the front part of the casing and on the retaining means respectively.

One embodiment of our invention is illustrated by way of example in the drawing accompanying the provisional specification in which

Figure 1 is a part sectional elevation of a projectile constructed in accordance with the invention.

Figure 2 is a sectional elevation on an enlarged scale of a portion of the projectile shown in Figure 1.

Referring to the drawing, a hollow-charge projectile casing comprises a front

part 1 and rear part 2 and contains an explosive charge 3 compressed between the rear part 2 and a conical metal lining 4. The front part of the casing is provided with a nose-fuze 5 adapted to be detonated on impact with the target, the detonation being transmitted by means of a detonating fuze 6 to a priming charge 7 located near the base of the explosive charge 3. The front part of the casing is provided with an outwardly directed flange 8 adapted to enter the mouth of the rear part and to be held in abutment with the rim of the conical lining 4 by a re-entrant flange 9 which constitutes the rear end of the front part of the casing. A resilient felt washer 10 is adapted to fit over the said front part to bear against the flange 8 thereon within the mouth of the rear part of the casing, the axial thickness of the said washer being such that a portion thereof protrudes from the mouth of the rear part of the casing. The mouth of the said rear part is provided with a rolled-on screw thread adapted to engage a corresponding thread 11 within a ring 12, which ring is also provided with an inwardly directed flange 13 adapted to bear upon the protruding portion of the resilient washer and to bear slidingly against the front part of the casing.

An annular V-section sealing ring 14 is provided in the interior of the rear portion to prevent the explosive charge being forced into the annular space occupied by the washer. A strip of adhesive tape 15 is also secured around the outer surface of the flange 9 of the front part of the casing in such manner as to prevent metallic frictional engagement between the front and rear parts of the casing during assembly after loading. The rear part of the casing of the projectile is provided with an extension 16 on which is mounted a tail unit 17 adapted to guide the projectile in its flight towards the target.

Assembly of the projectile is effected by the following sequence of operations. The rear part of the casing with associated parts pre-assembled thereon is loaded with the priming and explosive charges, the sealing-ring 14 being held in position on the inner wall during the loading in the form of a plain annular ring of which the upper portion is subsequently turned inwardly over the explosive charge. The front part of the casing with the conical lining and adhesive tape 15 secured thereto is then entered within the mouth of the rear part without relative rotational movement between the parts. The resilient washer is then entered into its housing and the threaded

ring 12 positioned for screwing on to the rear part. Axial pressure without relative rotational movement is then exerted on the said front and rear parts and assembly is completed by screwing the ring on to the threaded portion of the rear part to compress the resilient washer between the flange 8 on the front part and the flange 13 on the ring.

A further form of the present invention will now be described with reference to the accompanying drawing which is a sectional elevation, corresponding to Figure 2 of the provisional specification, of a portion of a modified projectile embodying the invention. In this drawing the reference numerals 1 to 4, 6 and 8 to 15, have the same significance as in Figure 2 of the provisional specification. The ring 12 is however constructed in the manner shown having the flange 13 set back at an angle to the cylindrical screw threaded portion 11, so as to form a sharp corner between the flange and the cylindrical portion. The construction of the ring in this manner substantially increases the accuracy of assembly.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed we declare that what we claim is:—

1. A projectile of the kind described which includes a two-part casing comprising a front part and a rear part adapted to be assembled under pressure but without relative rotational movement between the said parts, an abutment on the front of the casing against which the metal lining bears, retaining means in screw threaded engagement with the rear part of the casing and adapted to hold the two parts together after such assembly, and a resilient washer located between two flanges formed on the front part of the casing and on the retaining means respectively, said resilient washer permitting longitudinal displacement of the front part and the metal lining relative to the rear part under the influence of temperature changes.

2. A projectile as claimed in Claim 1 in which the retaining means comprises a ring screwed to the rear part of the casing and having an inwardly directed flange acting as the forward bearing surface for the resilient washer.

3. A projectile as claimed in Claim 2 in which the rear surface of the resilient washer bears against an outwardly directed flange on the front part of the casing, the metal liner bearing against the inner surface of the said flange.

4. A projectile as claimed in any of the preceding claims in which an annular

V-section sealing ring is provided in the interior of the rear portion of the casing in order to prevent the explosive charge from being forced into the annular space occupied by the washer.

5 A projectile as claimed in any of the preceding claims in which a strip of adhesive tape is secured around the outer surface of the flange formed on the front 10 part of the casing and is adapted to prevent metallic frictional engagement between the front and rear parts of the casing.

6 A method of assembling projectiles 15 as claimed in any of the preceding claims according to which the charge of explosive is loaded into the rear part of the casing, the liner and the front part of the casing then being inserted in position 20 and the charge compressed, without rela-

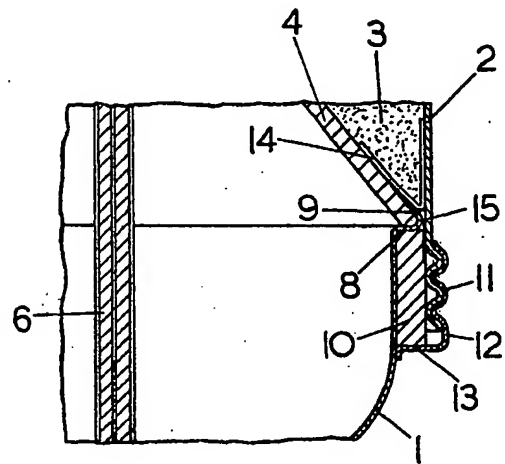
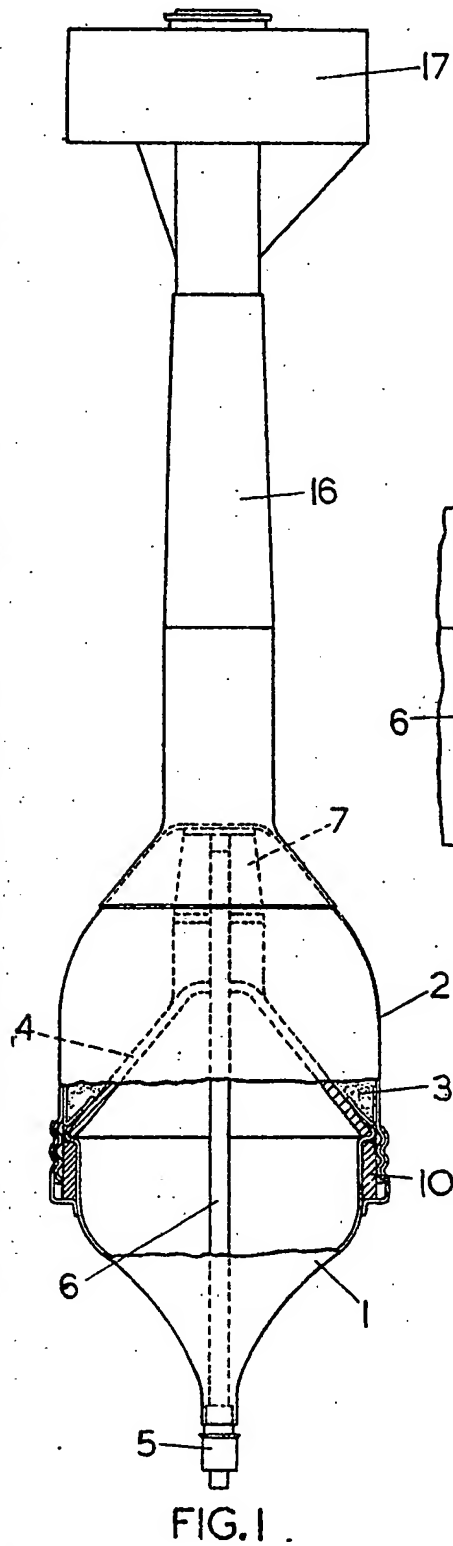
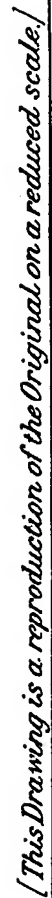
tive rotational movement between the parts, by axial pressure applied to the liner through the front part, the said front and rear parts being thereafter secured together by screwing on to the 25 rear part of the casing the retaining means co-operating with the resilient washer located between the two flanges formed on the front part of the casing and on the retaining means respectively. 30

7. Explosive projectiles and methods of assembling the same substantially as hereinbefore described with reference to the drawing accompanying the provisional specification and with reference to 35 the accompanying drawing.

Dated the 24th day of November, 1943.

E. A. BINGEN,  
Solicitor for the Applicants.

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*[This Drawing is a full-size reproduction of the Original.]*

